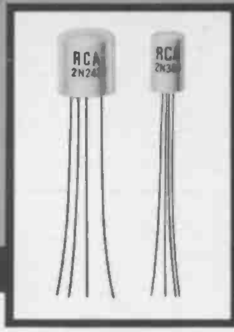
HAM TIPS

A PUBLICATION OF THE RCA ELECTRON TUBE DIVISION

VOL. XVIII, No. 3 JUNE, 1958



A TRANSISTORIZED GRID-DIP METER

Part II: Operation and Use

By Clarence A. West, W2IYG

RCA Electron Tube Division, Harrison, N. J.

W2IYG's two-part feature article began in the April, 1958, issue of HAM TIPS, which contained a description of the transistorized grid-dip meter designed and constructed by the author along with details of its construction. If you missed Part I, ask your local RCA distributor for a copy.

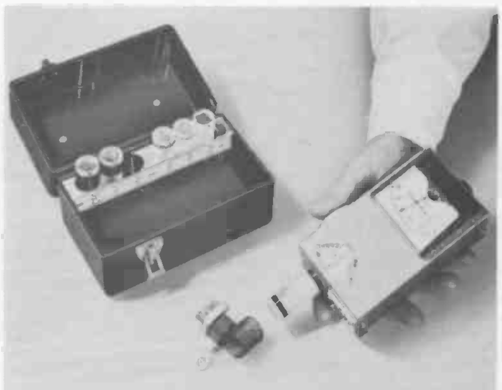
The transistorized grid-dip meter described in this article was designed primarily for determining the resonant frequency of tuned circuits quickly and with accuracy. To use the instrument for this application, estimate the approximate resonant frequency of the unknown tuned circuit and insert a coil having suitable frequency range. Switch on the instrument, adjust the meter control knob for a meter reading of about half-scale, and then tightly couple the coil to the unknown tuned circuit.

Keep both coils in the same plane for maximum coupling. Starting at one end of the tuning dial, rotate the dial slowly until a *pronounced* dip in meter reading occurs, then back the instrument off and tune through resonance again. Use loose coupling for accurate measurements, as indicated by a very small dip in meter reading.

Be sure the transmitter plate supply is turned off when "dipping" tank circuits in transmitters. There is danger of shock if this precaution is not observed.

The instrument may be used for many other applications including:

Signal Generator—To check the alignment of a receiver, tune the receiver, with AVC on, to a frequency at which no signals are present. Locate the instrument a few feet from the receiver at some convenient point along the receiver transmission line and tune to the receiver frequency as indicated by an "S" meter reading. Because there is no need to disconnect the line from the receiver, an accurate alignment check is provided with the



W2IYG's transistorized grid-dip meter being used to measure the frequency of a tuned circuit. (Note instrument carrying case with coil-storage rack. The case is made from two plastic cases, such as Allied 86P286, fastened together with a small set of hinges. A handle and lock complete the case. The coil storage rack is cut from a thin sheet of aluminum and riveted or screwed into place. Coils and dial window are color coded to indicate frequency range of coil in use.)

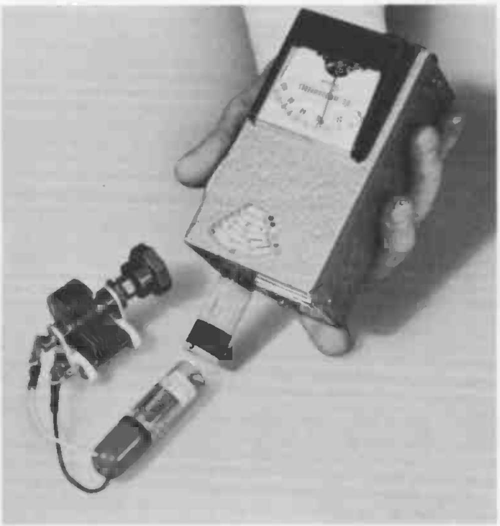


Figure 1: Use of author's grid-dip meter to measure value of an unknown capacitor. The standard inductance consists of 15¾ turns of B&W Miniductor #3003 (½-inch diameter, 16 TPI) enclosed in an Amphenol coil form type 24-5H. Note use of adapter with clip leads for connection to unknown capacitor.

existing antenna system and receiving conditions.

Field Strength Meter—Set the operating switch to the "off" position and connect a short length of wire to coil socket pin No. 2. *No coil is needed for this application* because the short length of wire serves as the pickup. The instrument can now be used to indicate rf voltages up through the VHF region. In this application, only the indicator portion of the instrument is utilized.

As an example of its use in loading an rf amplifier, couple the instrument loosely to the antenna transmission line by means of a short length of wire. Keep the instrument and pickup wire far enough away from the final amplifier tank to prevent excessive rf pickup from the tank itself. Tune and proceed to load the amplifier, observing the field strength meter. With increased loading, both the field strength meter and plate current meter of the amplifier will indicate increased readings. For maximum output, coupling should be increased until the field-strength-meter reading reaches its peak. With overcoupling, the plate current will continue to rise and the field-strength-meter reading will drop. Adjust the coupling to maintain the highest field-strength reading with the lowest plate current reading. Be sure to maintain resonance of the amplifier.

Monitor—Because the battery in the instrument is disconnected for *field-strength* use, the instrument may be placed conveniently anywhere in the shack and utilized as a visual monitor of all transmissions. Use a length of wire, as described previously, to serve as an rf pickup. A pair of high-impedance headphones plugged into the jack can be used for monitoring an amplitude-modulated signal.

Neutralizing Indicator — Using the instrument as a field-strength meter, couple the pickup wire to the plate tank coil of the amplifier stage to be neutralized. Plate and screen-grid voltages must be off, but full drive applied to the input circuit. Tune the plate tank circuit to resonance as indicated by maximum reading on the field strength meter. Adjust the neutralizing capacitor for minimum reading. If initial meter reading is too low, increase coupling to the tank by wrapping the pickup wire around the tank coil or by forming a single- or several-turn loop and returning the free end of the pickup wire to the instrument case or coil pin No. 4. Adjust the neutralizing capacitor for minimum rf indication.

Wavemeter—If it is desired to utilize this instrument as a wavemeter, a DPST switch should be used in place of the SPST switch shown in the circuit diagram in Part I. Wire the switch to open both the base circuit at the transistor and battery circuit when the switch is in the "off" position.

To check the output frequency of a trans-

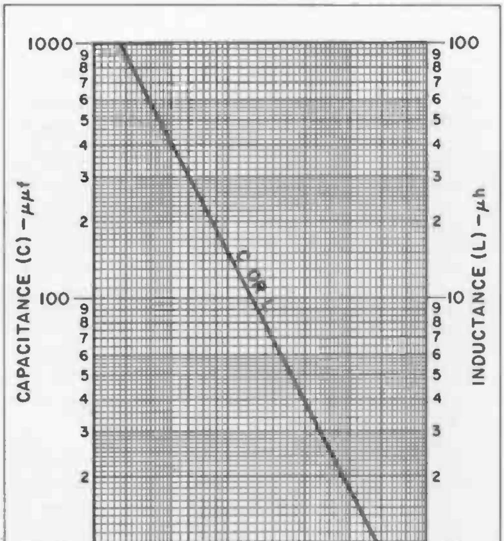


Figure 2: Chart for determining unknown values of L and C in the range 1 to 100 μh and 10 to 1000 μμf using an 18 μμf capacitor and a 1.3 μh inductance as standards.

mitter, insert a plug-in coil which will provide the instrument with the desired tuning range. The operate switch should be in the "off" position. Turn on the transmitter and *loosely* couple the wavemeter to the desired tank circuit. Tune the wavemeter for maximum meter reading. The tuning dial will indicate the output frequency of this stage.

Measurement of Capacitance or Inductance Values—The value of a capacitor in the range of 10 to 1000 $\mu\mu$f can be measured as follows: Connect the unknown capacitor across a 1.3 μh standard coil as shown in Figure 1. Starting with the lowest-frequency-range coil plugged into the instrument, de-

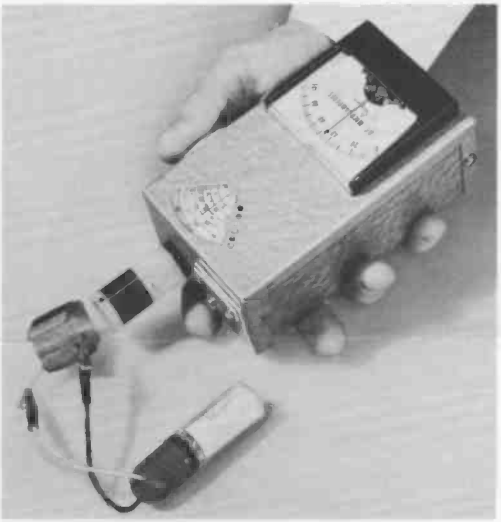


Figure 3: Use of grid-dip meter to measure an unknown inductance. A standard capacitor of 18 $\mu\mu$f is utilized. This standard capacitor is mounted inside an Amphenol type 24-5H coil form.

termine the resonant frequency of the standard coil and the unknown capacitor. When the resonant frequency is found, utilize the chart shown in Figure 2 to determine the value of the unknown capacitor. A capacitor of 100 $\mu\mu$f, for example, will resonate with the test coil at a frequency of 12.2 Mc.

The value of an inductance in the range 1 to 100 μh can be accomplished in a similar manner, except a standard capacitor of 18 $\mu\mu$f is utilized. Connect the standard capacitor across the unknown inductance, as shown in Figure 3, and determine the resonant frequency of this circuit. Utilizing the chart, determine the value of the unknown inductance. An inductance of 5 μh, for example, will resonate with the standard capacitor at a frequency of 17.5 Mc.

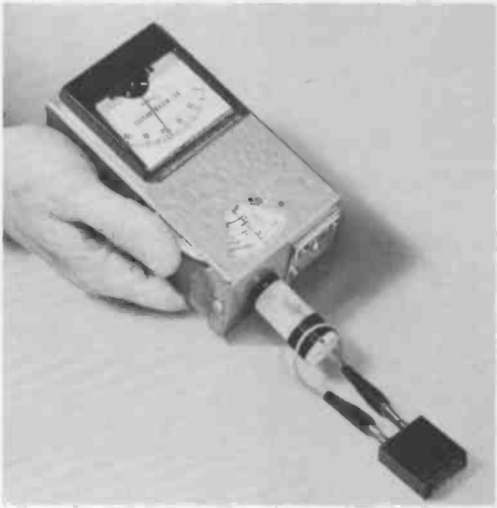
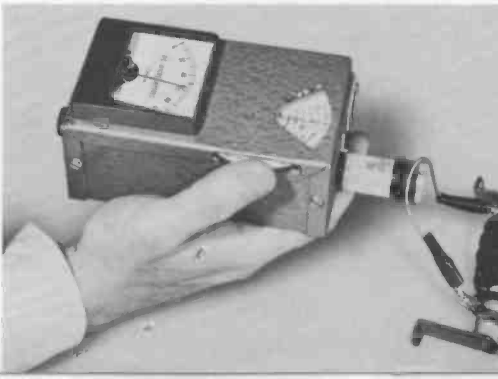


Figure 4: Use of grid-dip meter to test a quartz crystal.

Testing Quartz Crystals—The frequency of a quartz crystal may be determined by connecting a short length of wire to each of the crystal holder pins to form a small loop (see Figure 4). Couple the grid-dip meter coil tightly by inserting the coil inside the loop of wire. Tune the instrument slowly until a dip occurs, then loosen the coupling and re-"dip" the circuit. Read the crystal frequency on the tuning dial. This test also indicates activity of the crystal. The meter will not dip with an inactive crystal.

Checking RF Chokes for Self-Resonance—It is important that rf chokes used in parallel or shunt fed circuits be free of series resonance over the operating frequency range of the circuit to prevent their burning out. The popular pi-tank circuit is such an example in which the rf choke is shunted across the full rf output of the tube. To test the choke for series resonance, short-circuit the choke and determine its resonance frequencies with the grid-dip meter, as shown in Figure 5.

Figure 5: Use of grid-dip meter to test series resonant frequency of an rf choke.



RCA

From your local RCA distributor, headquarters for RCA receiving and power tubes.

RCA HAM TIPS is published by the RCA Electron Tube Division, Harrison, N. J. It is available free of charge from RCA distributors.

Harvey Slovik, Editor
Robert Leedy, W2PMP
Technical Editor

RADIO CORPORATION OF AMERICA
ELECTRON TUBE DIVISION
415 SOUTH FIFTH STREET
HARRISON, NEW JERSEY

SEC. 34.66 P.L.&R.

WHEN MAILING PLACE POSTAGE HERE

READING PA.

U.S. POSTAGE 01½

PB METER 314629

FORM 3547 REQUESTED

Longer Life for Your RCA-6146 Beam Power Tube

Due to the extreme popularity of the RCA-6146 beam power tube among hams, HAM TIPS again presents a few do's which should help you to considerably increase the already long life of this type.

- Hold heater voltage at 6.3 volts—at tube terminals.
- Provide for adequate ventilation around tube to prevent tube and circuit damage caused by overheating.
- Keep shiny shielding surfaces away from tube to prevent heat reflection back into tube.
- Design circuits around tube to use lowest possible value of resistance in grid circuit and screen circuit.
- In high frequency service, operate tube under load conditions such that maximum rated plate current flows at the plate voltage which will give maximum rated input.
- Have overload protection in plate and screen circuits to protect tube in the event of driver failure.
- See that plate shows no color when operated at full ratings (CCS or ICAS conditions).
- Reduce B+ or insert additional screen resistance when tuning under no-load conditions to prevent exceeding grid-No. 2 input rating.
- Maintain tuning and loading adjustments precisely so that tube will not be subjected to excessive overload. The 6146 is a high-gain, high-perveance tube and can be more easily overloaded through circuit misadjustments than older types not having such features.
- Use adequate grid drive, keeping within maximum grid-current and screen dissipation ratings of tube. Too little grid drive can cause high plate dissipation.
- Make connections to plate with flexible lead to prevent strain on cap seal.
- Operate 6146 within RCA ratings as shown in technical bulletin available on request from RCA Commercial Engineering, Harrison, N. J.